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Book Note

A Behaviorist's Biologist: Review of Philip J. Pauly's *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology*

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Describing the origins of behaviorism is not a simple matter. Many factors led up to John Broadus Watson's (1913) behaviorist manifesto, and many more were responsible for the subsequent growth and development of behaviorism exemplified by the work of B. F. Skinner. Now, as a result of Philip J. Pauly's book, *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology,* there is an additional perspective on these issues. Pauly's book describes the life and work of biologist Jacques Loeb in fascinating detail, including information on his personal experiences, as well as his experiments, theories, and writings. The book ends with brief descriptions of the lives of several well-known biologists and psychologists whose work was directly affected by that of Loeb. Through these helpful latter sections, which include pieces on Watson and Skinner, and through the book's preceding material, it is possible to identify many close links between behaviorism and biology.

Loeb was born in 1859 in Germany. His parents both died before he was 18. Although Loeb initially attended school to prepare for a business rather than a university career, he subsequently worked in business for only one year. After his father died, Loeb decided to prepare for university entrance, and in 1880 he enrolled at the University of Berlin, emerging several years later with a degree in medicine. Unfortunately, Loeb was unable to obtain a long-term job that would allow him to pursue independent research, his fervent goal. In 1890 he met and married Anne Leonard (a relative of G. Stanley Hall) of Massachusetts while both were in Zurich (she was there obtaining her Ph.D.). In 1891 Loeb emigrated to the United States. His first job was a temporary instructorship at Bryn Mawr. One year later, he was appointed to the position of assistant professor at the new University of Chicago. Approximately 10 years following the Chicago appointment, he moved to the University of California, and around 1910 he made his final move to the Rockefeller Institute in New York City. Loeb died in 1924 while on a trip to Bermuda.

During his lifetime Loeb conducted a large variety of experiments, including his well-known research on tropisms, colloid chemistry, and artificial parthenogenesis. The last of these was quite controversial. It involved inducing a sea urchin ovum to develop into a sea urchin larva without benefit of a sea urchin sperm.

What is most relevant for behaviorists is the period of Loeb's career in which he pursued his engineering approach to biology (1890–1915). During this period, Loeb's vision of biology was similar to the way in which an engineer sees his work, as a practical, useful, controlling, rather than theoretical, enterprise. Pauly relates how Loeb was shaped so as to advocate this position. As part of his training, Loeb was exposed to the work of Goltz and Pfluger, both of whom had rather unconventional (at that time) interests in physiological self-regulation, as opposed to the more usual interest in au-

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tomatic physiological functions in adult vertebrates. Later, work with agricultural scientists such as Sachs enabled Loeb to look at physiology with a more activist, interventionist, controlling attitude than did most of the other physiologists at that time. Loeb was also fortunate to have the facilities of the Naples Zoological Station available to him, so that he was able to perform extensive research on lower animals. Finally, Loeb was greatly attracted to the ideas of such theorists as Mach, who advocated the unification of science and technology. Loeb engaged in a long correspondence with Mach.

Some of Loeb's research could be easily described as coming under the province of what we now call psychology. For example, he conducted experiments on psychophysics, optical illusions, and tropisms. While at Bryn Mawr, he requested a laboratory for teaching human and comparative psychology. In all of Loeb's psychological research, he adhered to models that emphasized data rather than psychological theory.

For behaviorists, probably the greatest significance of Loeb's work was his influence on Watson and Skinner. There were many points of contact between Loeb and these two, most famous, behaviorists. As Watson relates in his autobiography (1936), while in graduate school at the University of Chicago between 1900 and 1903, he took a course with Loeb. Loeb wanted Watson to do his Ph.D. thesis with him, but Donaldson and Angell felt that Loeb was not a very safe choice, and ultimately Watson worked with them. However, Watson felt that he owed an unrepayable debt to Loeb. Later, when Watson had joined Johns Hopkins University, he corresponded and worked with Yerkes, who was also strongly influenced by Loeb's work. In Skinner's case, the only two science books that Skinner read as an undergraduate were two books by Loeb. Between college and graduate school, Skinner read Watson's *Behaviorism* and, based on that book, decided to become a behaviorist. In graduate school, Skinner was trained by another strong advocate of Loeb's work, Crozier. A quote from Skinner on the jacket of Pauly's book describes the book as "the fascinating story of a too-often neglected figure in the history of the biological and behavioral sciences."

The degree of similarity between Pauly's description of Loeb's engineering biology and Watson's and Skinner's behaviorism is astounding. For example, both research areas have emphasized control of the phenomena under study, have seen no division between science and technology, and have led to the development of useful technologies (in biology, innovations such as the birth control pill; in behaviorism, innovations such as teaching machines). Scientists in both areas have felt it important to study the organism as a whole and have been opposed to dualism. Both have felt it important to construct models that focus on data, as opposed to theories, as much as possible, and both have been opposed to purely psychological concepts such as will. Finally, both have been advocates of a positivistic approach to science. Pauly goes so far as to describe Watson's 1913 behaviorist manifesto as setting out "the Loebian engineering standpoint in psychology" (p. 174).

The similarities between engineering biology and behaviorism also extend to the personalities and styles of their founders. Loeb, Watson, and Skinner have all been polemical, action-oriented, pragmatic scientists. None have been interested in unresolvable, philosophical questions or in working out the minute details of a problem. All have been very creative men who have continually sought out new and interesting questions and have shown little caution in expressing their opinions in print. One major difference between these men, however, a difference not pointed out by Pauly, is that while Loeb's goal was to develop biology so as to satisfy all sorts of useful goals, he was very careful in drawing any but the most limited implications from his own work. This would probably not be said about Watson and Skinner. Perhaps this difference is part of the reason why, as Pauly notes, even during the height of publicity surrounding Loeb's discovery of artificial parthenogenesis,

there was little or no public discussion of the possible moral and ethical repercussions that could follow from such a discovery. Behaviorism has not enjoyed such treatment from the popular press.

There are some problems with Pauly's book that will be apparent to anyone knowledgeable in the history of behaviorism. For example, in describing Watson's life Pauly relies frequently on Cohen's (1979) unreliable biography of Watson. In addition, the reader will sometimes find it difficult to determine exactly when a particular critical event occurred, a frustrating experience. However, overall the book appears accurate and informed. It is well-written, nicely balancing useful detail, general statements of theory, and summary comments. The reader feels completely immersed in the exciting world of experimental biology and eagerly awaits each new discovery from Loeb's laboratory. Finally, Pauly has done behaviorism a great service in demonstrating so clearly the important role that Loeb played in the origins of behaviorism.

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